

# **Silviculture Definitions and Descriptions – Hungry Ridge Restoration EIS**

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### **Non-commercial vs commercial silvicultural activities**

Non-commercial silviculture activities are defined as activities in which trees being removed are not commercially marketable; they have no economic product value. Their inherent product value is equal to zero; thus, the operation has no ability to defray the cost of operations.

Commercial silviculture activities are defined as the opposite. These are activities in which trees being cut and removed are extracted for useful products having marketable value. The activity is considered commercial even if the value does not defray the entire cost of the operation (Smith, 1962). For example, when a thinning activity is implemented, if the trees cut are slashed and left on the unit, then these would have zero value as a product; this would be non-commercial (pre-commercial thinning). However, if all or a partial number of the cut trees are removed and sold as a biomass product, the thinning would be considered a commercial thinning.

### **Silviculture Treatment Considerations**

A silviculture treatment is a process or action that can be applied in a controlled manner, according to the specifications of a silviculture prescription (Hoffman et al, 1999). The purpose of such is to improve actual or potential benefits to a forest stand based on some objective. Silviculture treatments, and thus their silviculture prescriptions, are generally subdivided into two methods: regeneration or intermediate treatments.

#### **Regeneration Treatment Methods**

Regeneration treatment can be defined as a harvest method in which the silvicultural purpose is to reforest or regenerate a forest ecosystem or stand either naturally or artificially (by planting). It is the act of replacing/renewing an older forest condition with younger, healthier trees. Regeneration treatments could have several reasons or “prescriptive” objectives that direct the need to regenerate a forest ecosystem or stand. Prescriptive objectives may include harvest of mature, diseased or insect-infested stands composed primarily of late to mid-seral shade tolerant species in order to favor early seral species, which are more fire-tolerant and insect and disease-resistant. Long lived, early seral species (ponderosa pine, western larch) and other large-diameter trees would be retained where available for vertical structure. Snags and large wood recruitment would also be retained in regeneration areas, but only if post-treatment fuels objectives and operational/personnel safety are not compromised. Some regeneration treatment units within the Hungry Ridge project are large and exceed 40 acres, so landscape considerations are important to the overall project. In consideration, regeneration prescriptions will be varied in an attempt to imitate forest disturbance at the landscape scale.

**Regeneration Treatment Method prescriptions are as follows:**

1. **Clearcut with Reserves (CCR).** Clearcut with reserves would remove green merchantable live trees and reserve a minimum of 6 trees per acre greater than 12 inches diameter breast height, . If wildlife objectives need to be met, additional reserve trees can be left, up to 10 trees per acre. Reserve trees would be selected based on wind-firmness, diameter size and wildlife characteristics. Preference would also be to clump reserve trees versus scattering of individual trees. Live biomass may or may not be treated through harvest. Site preparation for regeneration would occur to remove non-merchantable live trees. Site preparation may be mechanical or through controlled fire activities. Site preparation would only occur to meet fuel or regeneration objectives. Large woody debris would only be treated to meet post-harvest fuel objective. Regeneration would be accomplished through artificial means, planting.

**Clearcut with Reserve Islands (CCRI).** Clearcut with Reserve Islands would remove green merchantable live trees and reserve untreated islands of trees. Islands would be selected and kept as untreated, and would retain the stand dynamic characteristics of the pre-treated stand. Islands selected would be from ¼ acre to 2 acres in size. A minimum of 2% to a maximum of 10% of the ground base would be applied. Sizes over 2 acres could be applied for wildlife objectives, but application would be based on specific need. Based on current habitat type stocking, reserve trees within the islands would relate to 10 to 50 residual reserve trees per acre. Island locations would be dependent on specific stand objectives, but could focus on large trees, higher snag populations, large woody debris, or wildlife landscape connections. Site preparation, snag retention, and large woody debris retention would be the same on treated acres as described under the clearcut prescription. Activity fuels treatments, site preparation and planting would be the same as Clearcut with Reserves above.

2. **Seed Tree (ST)** – Eight to fifteen trees per acre (10-30 ft<sup>2</sup> basal area per acre) would be retained as residual seed trees. The actual leave number would be dependent on the diameter of the residual seed trees. Only early seral species absent any insect and disease would be preferred as residual seed trees. Residual seed trees would be high- quality, high-vigor trees, desirable for seed production. Natural regeneration would be the method of regeneration. Seed trees would be retained to meet reserve tree retention standards. Additional reserve trees would only be left to meet secondary wildlife objectives. Site preparation may be mechanical or through controlled fire activities. Both natural and artificial regeneration would be considered in meeting the regeneration objective.
3. **Shelterwood (SW).** Fifteen to forty trees per acre (30-40 ft<sup>2</sup> basal area per acre) would be retained as residual shelter trees. The residual leave number would be dependent on the diameter of the residual shelter trees. Early seral tree species (ponderosa pine, western larch), absent insect and disease, would be preferred as residual shelter trees. However, depending on habitat type and stand conditions, mid-seral species may be left. Reserve trees would only be left to meet secondary wildlife objectives. Site preparation may be

mechanical or through controlled fire activities. Both natural and artificial regeneration would be considered in meeting the regeneration objective.

### **Intermediate Treatment Methods**

Intermediate treatment methods are used to modify the stand dynamic of a stand after regeneration establishment and prior to the final stand treatment or harvest (Forest Service 2004). Unlike the regeneration treatment methods, these treatment methods have no objective for obtaining regeneration. Some intermediate treatment objectives would include: improve or modify growing conditions for residual stands, improve overall stand vigor, change the species composition of the stand, change the stand structure, reduce stand crown densities, and increase the distance between surface and crown fuels, thus reducing crown fire hazard.

For this project, intermediate treatments would primarily remove encroaching late seral species (grand fir and Douglas fir), thus changing stand species composition or converting the stand primarily to an early seral species (ponderosa pine or western larch). Large-diameter trees would be favored as residual trees to provide additional long-term structural diversity. Silviculture objectives of intermediate treatment prescriptions would be to adjust species composition, improve forest health through treatment of insect and disease, and improve growth conditions for the residual stands. On average, residual basal area stocking levels would vary dependent on residual leave species, prescription type, and prescription objectives.

### **Intermediate Treatment Method prescriptions are as follows:**

1. **Pre-commercial Thinning (PCT).** Is a prescription in which the stand generally has not grown to a size in which the trees to be removed are commercially marketable, or the activity is removing a smaller-sized cohort of an older stand. Small-diameter trees, generally under 8" at diameter breast height (dbh), would be removed based on a desired residual spacing. Most stand conditions receiving this prescription would be advanced regeneration found in plantation situations. These stands generally are well-stocked and have very little intra-stand variability; thus, conditions are consistent across the stand. Since these stands do not have a wide variability in tree size or height, spatial thinning is the preferred method of thinning. Spatial thinning is a density thinning based on a distance-spacing guideline. Trees are removed and retained based on a desired spacing distance between trees. Spacing and the residual trees per acre are dependent on the stand's species composition. Early seral or shade intolerant species (ponderosa pine) generally are thinned on a wider spacing (18 to 20+ feet), while mid-seral species or more shade tolerant species are thinned at narrower spacing (12 to 17 feet). This prescription will generally be used for younger or smaller-sized stands (plantations) with very little intra-stand variability. Preference selection for species composition and quality would be limited, but would be accomplished within the spacing guidelines of the prescription. Treatments could be accomplished by hand or mechanical methods of removal.

2. **Commercial Thinning (CT).** Commercial thinning generally uses a mix of basal area measure and tree spacing to implement this intermediate treatment. A standard commercial thinning focuses on a single objective, improving growing conditions for the residual stand. Commercial thinning prescriptions improve growing conditions for the residual trees. Prescriptions would reduce stand basal area densities and canopy crown closure. Basal area and tree spacing would have some variability but would be a narrower range as compared to a variable density or forest density thinning. On average, basal area density would be between 80 and 100 square feet for the early seral-dominated stands and between 90 and 110 square feet for the mid to late seral-dominated stands. Basal area would vary dependent on residual tree size. Crown canopy cover is estimated to vary from 60% to 70%, dependent on trees species composition and residual tree size. Controlled under-burning would be supported in early seral commercial thinning to control fuel levels, but also to control or limit late seral species-encroachment or regeneration. Fuel levels in late seral species would be managed through mechanical operations, while young advanced regeneration would be managed through pre-commercial hand operations.

In this project, commercial thinning would favor the largest and healthiest western larch, ponderosa pine, Douglas fir, and Engelmann spruce. Grand fir would be the residual leave tree of last preference. Where available, western larch and ponderosa pine will be retained at higher composition levels to support retention of fire tolerant, early seral species. Grand fir or Douglas-fir could be retained for snag recruitment, vertical diversity, canopy cover, and to serve as shelter for wildlife, but should not be reserved in areas with active root disease, as it has been demonstrated that root disease will become more pervasive after harvest (Hagle, USDA, Feb. 2008; Management Guide for Armillaria Root Disease; Pg 14.).

3. **Variable Density Thinning (VDT).** Variable Density Thinning, is recognized as a special intermediate treatment method. This method is best suited to be applied to stands that have high variability and are inefficient to map for management purposes. The stand generally has a variety of stand conditions, composition, and characteristics. The stand prescription manages the silviculture treatment based on the existing stand conditions on the landscape. Because the stand's density is variable, the resulting stand will retain the variability once the prescription is implemented. Tree removal increases inter-tree spacing in order to accelerate growth and improve tree vigor, as well as to manipulate and control forest density to achieve one or more resource objectives. Forest density thinning is often used to improve forest health, open the canopy for selected trees or species, to maintain understory vegetation, or to promote both late and early successional legacies for biological diversity (Helms 1998). This treatment method can be interpreted as implementing multiple intermediate treatment methods when the layout and mapping of each method would not be feasible due to unit size.

An implemented prescription under VDT will have a final unit basal area condition that would vary from a complete opening to a basal area of the initial stand (areas not treated for biological diversity). Conditions will vary from small areas ½ acre to upwards of 5 acres depending on the initial stand conditions. Heavier removal thinning may be done around larger legacy trees to protect from landscape fires, while immature- aged species

may have a normal commercial thinning activity. The type of intermediate treatments would be dependent on the overall prescription objectives for the stand.

4. **Overstory Removal with Reserves (OSR).** Overstory removal methods are used in two-layered or multiple-layered stands that have a fully-stocked understory of advanced regeneration. The regeneration should be healthy and of a desirable species to meet objectives of the prescription. This harvest method somewhat mimics the removal cut of a shelterwood sequence of management. The method has several advantages, including capturing the stand's natural advanced regeneration or removing an overstory infecting the advanced regeneration. However, these advantages may also be the biggest disadvantage of this method. Advanced regeneration may be incompatible with many forest health issues and prescription objectives. Much of the advanced regeneration may be species that are mid to late seral, are shade tolerant, and that are highly susceptible to drought and diseases (root rots and stem decay) that are present on the landscape (Powell 2013). Therefore, this method needs to evaluate the landscape and advanced regeneration conditions carefully before application. If needed following application of this method, pre-commercial thinning is a follow-up treatment to manage the advanced regeneration stand conditions. Residual tree and snag retention applications would be implemented as described under the regeneration methods above. Residual tree retention could be as individual trees, small groups, or in an island configuration and would be specific to the prescription as determined by the silviculturist.
5. **Stand Improvement (SI).** A method of treatment in which a specific objective is implemented to improve/protect the current stand. Improvement could be from changes in composition, structure, stand condition, stand health, or stand tree growth. The goal of timber stand improvement (TSI) activities is to improve forest health or to accomplish other objectives by regulating stand density, removing competing vegetation and fuel ladders, and maintaining soil productivity (Powell 2013). TSI treatments are generally applied to immature forests; however, applications of TSI prescriptions to protect old growth legacy trees is an example that potentially could be used within the Hungry Ridge project. In this case, a prescription could remove immature, insect-infested, and diseased timber to protect the old growth structure for wildlife habitat. In this type of treatment, snag retention would be encouraged, large woody debris mechanical treatment for site prep would be avoided, and controlled fire would be used to natural-control fuel hazards.

Overstory Removal with Reserved or Stand Improvement treatments are not proposed in the Hungry Ridge Project.

### Summary of silvicultural treatments proposed in the Hungry Ridge Restoration Project<sup>1</sup>

Silvicultural Treatment	Trees/acre Remaining	Basal Area/Acre Remaining	% Canopy Cover Remaining	Average spacing Between leave trees (if evenly-spaced) In Feet
<b>Regeneration Treatment</b>				
Clearcut w/Reserves or w/Reserve Islands	6-10	6-20 sq.ft.	10	85 (6 trees) – 66 (10 trees)
Seedtree	8-15	10-30 sq.ft.	20	74 (8 trees) – 54 (15 trees)
Shelterwood	15-35	30-40 sq.ft.	30	54 (15 trees) – 35 (35 trees)
<b>Intermediate Treatment</b>				
a) Commercial Thin	90-110	80-110 sq.ft.	60-70	22 (90 trees) - 20 (110 trees)
b) Variable Density Thin	35-110	40-110 sq.ft.	30-70	Variable
c) Pre-commercial Thin	150-300	120-150 sq.ft.	70-90	17 (150 trees) – 12 (300 trees)

<sup>1</sup> Numbers in the table are based on an average tree diameter of 12” at diameter breast height (dbh).

### References

Hagle, USDA, Feb. 2008; Management Guide for Armillaria Root Disease; Pg 14

Helms 1998

Hoffman et al, 1999

Powell 2013

Smith, 1962